**Rivers: The Nile**

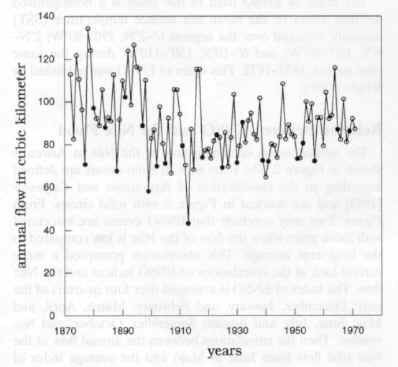
Among the few rivers that drain into the Mediterranean, the Nile is certainly the most important. It is the longest river in the world, flowing south to north 4,132 miles (6650 km) from equatorial Africa to the Mediterranean, and draining some 1,293,000 square miles, approximately 10% of the African landmass. The annual flood was fed by summer rainfall in the equatorial plateau (mainly via the White Nile) and the Ethiopian Highlands (mainly via the Blue Nile and Atbara rivers). Before construction of the Aswan Low Dam in 1902 (and its successors), the annual flood or inundation characteristically began with rising waters first observed at the first cataract (at Aswan) as early as June. Waters peaked in late summer (August to September) and generally receded by October, with sowing of the main crops poised to begin. High productivity was achieved by harnessing the flood through hydraulic management of a network of dikes, canals and enclosures to maximize groundwater recharge and alluvial deposition along Egypt’s ca. 745 miles (1,200 km) Nile valley. However, a major feature of the flood, driven by seasonal rainfall associated with the East African Monsoon in the Ethiopian highlands around Lake Tana and drained primarily by the Blue Nile, is its pronounced inter-annual variability. This was noted from ancient times, with insufficient or excessive floodwater (Nile “failure”) often coincident with famine and mortality throughout Egyptian history.

While the Nile ends up in the Mediterranean, the Nile is part of the Indian Ocean system. Rivers, in contrast to the fragmented world of the Mediterranean Sea, have been seen as highly constrained environments that “caged” populations. Social forces were centrigual; populations, generally, were not mobile. The irrigated landcsapes of the river valley produced highly centralized political hegemonies, or so the theory goes.[[1]](#footnote-1) The Nile is, by far, the most important river draining into the Mediterranean. It is the only major river that flows into the Mediterranean from Africa, although its flood volume is comparatively small compared to the world’s other great rivers.[[2]](#footnote-2) The climate drivers of the annual flood of the river are more complex than is usually described, but the main was was the Indian Ocen monsoon. There is a strong case to make that Egypt, as a result, was an Indian Ocean civilization.

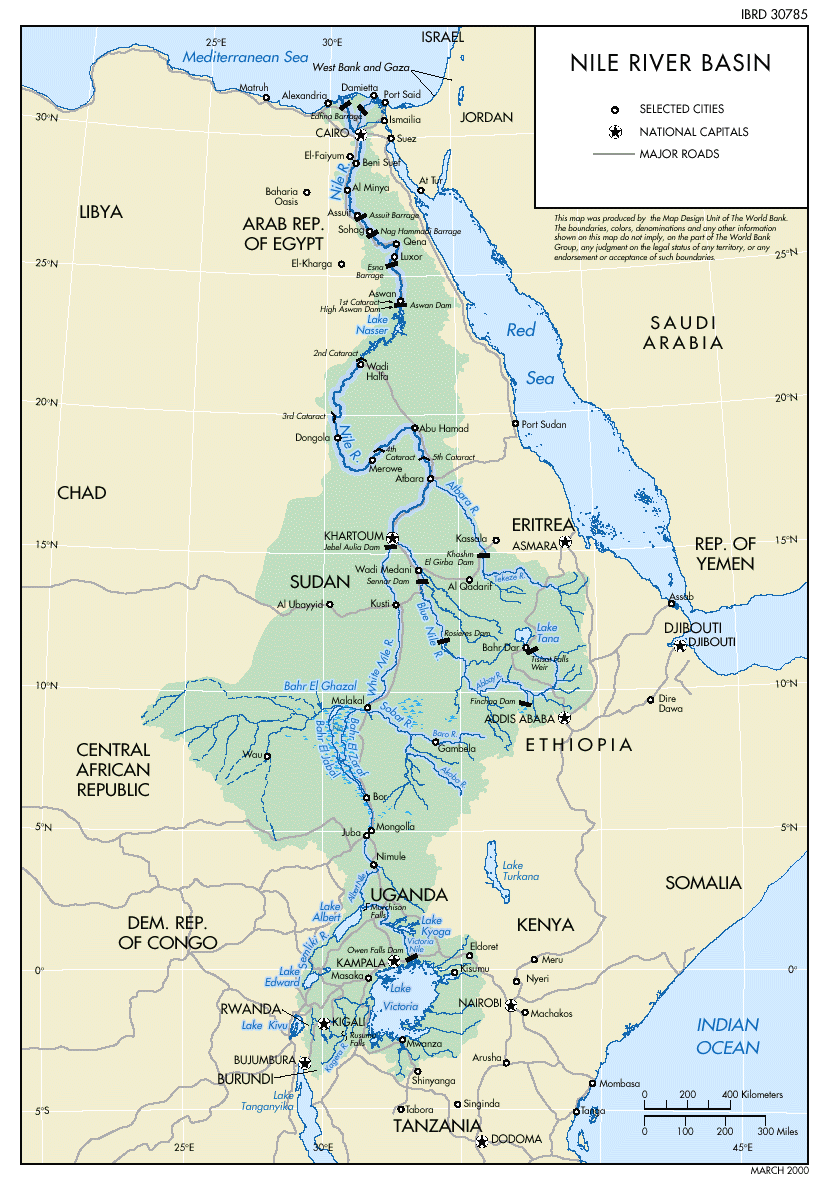
The annual flood surge, a marvel to ancient geographers, was caused primarily by the east African Indian Ocean monsoon, and monsoonal summer rain in the Ethiopian highlands. 83% of the flood surge in the Egyptian Nile is attributed to water coming from the Ethiopian highlands around Lake Tana, creating the Blue Nile, 13.8 % from the Atbara river, and 13.3 % from the Sobat river. 16.5 % of the water derives from the Great Lakes region, half of which is evaporated by the Sudd in modern Sudan.[[3]](#footnote-3) Even in recent times, the unique features of the Nile dictate agricultural production: 95% of production is on irrigated land, and the sources of the water lie entirely beyond Egypt’s borders.[[4]](#footnote-4) Despite the predictability and the slow flooding and recession of the water, there was considerable inter-annual variability in Nile flood volume. The adjustment, or social resilience, to this variability was one of the most important, if not *the* most important, drivers of Egyptian history, and bad flooding was a factor in the decline of centralized political control and concomitant economic and demographic decline.[[5]](#footnote-5)

Although Egyptologists often stress the consistency of the Nile flow, inter-annual variability occurred at several periodicities was the result of several natural features.[[6]](#footnote-6) The first is ENSO (The El-Niño Southern Oscillation), responsible for 25% of the variability.[[7]](#footnote-7) The second feature is known as the Hurst phenomenon: that the temporal fluctuation in flood volume is non-random, but the long-term flood pattern is chaotic in Mandelbrotian terms. As I discuss below, we now know with great certainty that volcanic forcing was also an important driver of poor flooding, perturbing the Indian Ocean monsoonal rains, and thus the annual flood, significantly.

Flood levels recorded in pharaonic, while far from complete, are sufficient to show the variability.[[8]](#footnote-8) Variability in the flood dictated settlement patterns throughout Egyptian history, as well as agricultural production, taxation levels and so on. That appears to be the case, for example in Middle Egypt where the flood plain is wide but more susceptible to flood shocks. The area shows an historic pattern of settlement and de-population.[[9]](#footnote-9)



**Fig. x. Annual fluctuations of the "natural" flow in the Nile at Aswan for the years 1872-1972 CE. From Eltahir (1996). Note the low flow around 1912-1913, reflecting, probably, the Katmai/Novarupta eruption in Alaska, 1912, the largest volcanic eruption of the 20th century.**



**Map x. The Nile river basin. The river drains 1,293,000 square miles, approximately 10% of the African landmass.**

The Nile river is the poster child for determinist views of the connection between irrigated landscapes and authoritarian rule, as most fully developed in Wittfogel.[[10]](#footnote-10) As much as Wittfogel’s overgeneralized theory has been criticized, from many point of view, theoretical and in specific historical contexts, the basic idea lives on in subtle ways.[[11]](#footnote-11) “Egypt” in perhaps Herodotus’ most famous line, “is the gift of the river.”[[12]](#footnote-12) Really referring to that fact that the delta was formed by alluvial deposits, it is more or less true, the oases and deserts not withstanding, that Egypt was indeed a gift of the river.

Rivers raise the issue of boundaries in a different way. The Nile, as the Maeander in Asia Minor as Thonemann observes, never “corresponded to a single political, ethnic or cultural unit.”[[13]](#footnote-13) The status of Egypt as being a part of the Mediterranean has been much debated in recent years.[[14]](#footnote-14) It does not easily fit, in a sense at the “the fuzzy edges” of the Mediterranean.[[15]](#footnote-15) In terms of climate, it can be better categorized as being part of the Indian Ocean indeed, its monsoon being the sole driver of the flow of water into Egypt. Egypt, historically and in some ways still today, serve s as a bridge between the Mediterranean and Indian Ocean worlds. It is the Delta that is the most important area for understanding the rich and deep history of exchange between Egypt and other parts of the Mediterranean world. Crete - Delta exchange networks very well documented from the Old Kingdom.[[16]](#footnote-16) Mycenaean influence reaching Thebes by New Kingdom, Egypt by Late Bronze Age part of a large network encompassing Cyprus, Levantine coast as well, as the famous Ulu Burun shipwreck demonstrates.[[17]](#footnote-17) The Delta continued to be important throughout the first millennium BCE with trade contacts with the Near East. Demotic Egyptian language and script, originating in the Delta and no doubt influenced by trade activity there, became by the 5th century BCE the standard script for the whole of Egypt. Major changes in contact language, and also an increase in private contracting over the course of the first millennium BCE.[[18]](#footnote-18)

Ancient Egypt was oriented southward, Egyptian maps were oriented south upward, toward the first cataract and the direction of Nile flow, and out toward the Red Sea. So too North Africa was oriented east-west along the coast and southward, not looking north across the Mediterranean.[[19]](#footnote-19) Egyptian historians are heavily reliant on evidence from southern Egypt because of the nature of the survival of material culture, so much of which comes from Thebes and the surrounding region. But also because activity southward, into Nubia and its gold mines for example, was stressed by early kings. Changed during the New Kingdom, the “age of empire” when Egypt controlled Nubia down to the fifth cataract of the Nile, and the Levantine coastal areas. 19th and 20th dynasties centered in Delta capitalized, and truly the beginning of much more of interaction in the Mediterranean. The Saite period, its Greek-staffed navy, then Persian control Ptolemaic then Roman. For the Greco Roman period, say 300 BC to AD 300, Egypt was in fact central, connecting the Mediterranean to the Red Sea and to India.

There are several distinct eco-zones in Egypt. The major divisions are the river valley, the delta, the Fayyum depression, the western oases, and the deserts.[[20]](#footnote-20) The Delta was the main bridge between the Nile valley and the Mediterranean during the first millennium BCE, and has twice the amount of potentially arable land as does the Nile valley.[[21]](#footnote-21) The Delta is receiving increased attention, and despite the overwhelming among of Greek papyri from the Fayyum, it also yields important documents that can be related to the hydrological history of the region.[[22]](#footnote-22)

That fact, illustrated by the map in Fig. xx contrast with what ancient historians typically focus on, which archival records from a handful of towns along the Egyptian river corridor, the oases, and the Fayyum. The river provided four main things:

(1) Water from the flood surge beginning each June overflowed the river banks and spread water and rich alluvial soils into basins in which grain crops were grown.

(2) Fish.

(3) A superb “communication corridor.”

(4) a rhythm to life, a unity of landscape and people, a sense of stability and fertility used to great effect by the rulers and their unique visual cultural expression of political ideology.

A natural transportation corridor as well: flowing south to north, prevailing winds from May to September, the Etesians, off the Aegean blow south.[[23]](#footnote-23)

It is no accident that an early, socially stratified, state emerged in Egypt around 3000 BC. Many early civilizations (Egypt, the Indus river valley, Mesopotamia, and China) were all civilizations based on flood recession agriculture.[[24]](#footnote-24) The rise of early states in river valleys, of course, must be explained by other factors as well. These important river valleys allowed the possibility of the centralization of political and economic power because of the caging effects of the river valley that “captured” a population within a circumscribed territory. The absence of political opposition at the local level in Egypt allowed the king to assert monopoly power over communications along the river as well as over raw materials (principally stone and metals used for tools), and the productivity of Egyptian soil produced large surpluses and allowed for “durable methods of taxation.”[[25]](#footnote-25) Flood recession agriculture yields high output per unit of labor, but no direct royal involvement in the administration of water.

In the economic history of Egypt, there has long been posited a direct causal link between the physical geography of Egypt and state power. To be sure, the origins of the ancient Egyptian state can be attributed to what Michael Mann has called the "social cage" created by Nile river and the narrow cultivable flood plain flowing northward through a harsh desert environment.[[26]](#footnote-26) That social cage allowed a ruler to control a population and monopolize communication along the river corridor. It was this basic "immobility" of primary agricultural producers that was the prime mover of state expansion and allowed extensive development of agriculture in Egypt.[[27]](#footnote-27)

Irrigation has long been thought to be the basis of a highly centralized, despotic form of state. This theory has been most famously developed by Karl Wittfogel in an influential book.[[28]](#footnote-28) The reverse is also discussed here, the correlations between poor Nile flooding and state collapse. The Wittfogel model, Karl Butzer mused, is a bit like Elvis, continuing appearing when one thinks it is dead.[[29]](#footnote-29) The model, to summarize, posits a causal connection between irrigation, managerial bureaucracy, and total power of the ruler. Many observers, and not only of Asian states, have observed in places with irrigation landscapes, there were massive building projects and large labor forces. Karl Marx’s “Asiatic mode of production,” and Max Weber’s “hydraulic bureaucracy” posited a strong correlation between irrigation societies, social complexity and centralized political power (1938, 1957).

Wittfogel’s monumental treatise (1957) summarized much 19th century historical thinking about the political economy of early states, particularly Asian states, which were associated with irrigation agriculture. His argument is complex, and his attempt to link water management to levels of technology, property rights, the structure of the state and social power was impressive. At its most basic level, the despotic model in Egypt was a “linear causality model”, that linked environmental stress to irrigation, the need to control irrigation networks led to the formation of a hydraulic bureaucracy, which in turn led to centralized control of economic resources. The theory, while very interesting, is over–generalized and overextended. While highlighting the differences between East and West, it oversimplified the complexities of irrigated societies both from the point of view in comparison--Egypt, Mesopotamia, China were all pretty much the same—and from the point of view of a particular society like Egypt, whose local social structure in relation to production was more complex and developed more over time than the model suggested. Wittfogel’s theory also emphasized scale: despotic states were the result of large-scale irrigation works that required large managerial bureaucracies to maintain. Both of these are incorrect for ancient Egypt.

The image of a static, unchanging Egypt, rich with grain and a physical marvel goes back to the Ionian geographers reflected in Herodotus’ ethnographic interest. Ancient Egypt would appear to be among the first and best examples of the resource curse, although it has never been considered so with respect to the modern economic theory. For the premodern world the broader questions is what the connection was between resources and governance. For my purposes here, I am going to equate the resource curse with the theory of Oriental Despotism in which Egypt has been a major component. Egypt’s irrigated landscape, its highly productive soil, the royal monuments built from the extraction of surpluses from a docile population, even cruelly extracted-an image already known in ancient texts- all suggest that Egypt suffered from, perhaps even invented, the idea of a state being cursed by its natural endowment, which I take to include the Nile river and its annual flood that formed the basis of agricultural production and social organization.

Those images of Egypt, and observations from other Asian states, beginning with Herodotus and Aristotle down to French political theory, Marx and Weber, led directly to the development of the theory of Oriental Despotism by Karl Wittfogel, a general theory that linked water resources to social structure and governance (further below). Despite this very ancient image of a state cursed by its resources--passive, never-changing, sterile and long used to despotic rulers-- that while there is a connection between physical geography, climate and governance, there was no causal link between the control of irrigation and authoritarian rule. The failure to democratize, of course, is not an issue in Egypt although it is an important part of the modern theory. What is, in fact, in need of explanation is the persistence of the pharaonic or authoritarian rule from 3100 BC down to the Ptolemaic regimes (305-30 BC).

Herodotus’ description of Egypt, occupying the whole of Book 2 of his *Histories*, is the first sustained narrative of ancient Egyptian society and history. It is also, along with the Joseph Story in the *Book of Genesis*, the earliest narrative of an Egypt cursed by its environment. In this text, written sometime in the middle of the fifth century BC, the physical geography of Egypt is described at great length. Famously, of course, Herodotus spends a good amount of time on the Nile, its sources and the annual flood of river, which came, remarkably from the Greek point of view, at the height of Summer’s heat. Indeed the first four books of Herodotus are in search of the answer to why it is that a ramshackle bunch of poor Greeks were able to defeat the mighty Persian empire when ancient and highly sophisticated civilizations such as Egypt were incorporated into the empire almost without a fight. The answer in part was a good Ionian one: geography and climate. Egypt, Herodotus tells his readers, was “the gift of the river.” In this famous passage (2.5), Herodotus was referring to the alluvial nature of the Delta. Be that as it may, the idea that Egypt was the gift of the river is incontrovertible. Agricultural production is entirely dependent of the Nile. Egypt was enormously rich because of the fertility of its soil. It had a deep and impressive history, learned priests, and possessed more marvels than other places, including the huge monuments of countless kings. But as a result of this richness, Egypt was weak. It was doomed to be invaded and possessed by Persia.

Everywhere there was irrigation there would follow highly centralized states, even in areas of rainfall: ancient Rome or Hawaii for example.[[30]](#footnote-30) Irrigation was the *cause* of centralization and political immobility. As Butzer has cogently argued, however, such a theory overestimates vertical power structures, and underestimates horizontal ones.[[31]](#footnote-31) “The hang-up,” Butzer concluded, “seems to be the tenacious assumption that early forms of intensification were a result of socio-hierarchical demands rather than cumulative, small-scale, local decision-making.”[[32]](#footnote-32) The emphasis in Egypt was generally on small scale production. Ancient Egypt was not the Egypt of Mohammed Ali or the post High Dam era, although there are important shifts, the shift to free-threshing wheat in the first millennium, and clearly a major part of Ptolemaic strategy.[[33]](#footnote-33)

The control of water was always managed at the local level, and was centered around the natural flood basins because local conditions of land and water varied, and irrigation networks, and the labor requisition required to maintain them, had to be managed locally. Unlike Mesopotamia, the gradient of the river did not allow more extensive radial canalization except in the Fayyum, and therefore the basin irrigation system was essentially locally managed.[[34]](#footnote-34) The lack of a central bureaucracy for irrigation, with no official titles linked to such centralized control shows that control of water had always been decentralized:

*Its management defied centralization and was handled*

*on a community basis. Unlike in the Karl Wittfogel model,*

*irrigation never involved a managerial bureaucracy,*

*nor did it become an instrument of authoritarian control*.[[35]](#footnote-35)

# Two types of irrigation of land must be distinguished.[[36]](#footnote-36) The first, natural or “paleotechnic” irrigation, was characterized by the simple social response to the annual rhythm of flood and recession of the Nile by sowing land in the low-lying flood basins along the convex river valley. The annual flood replenished nutrients in the soil and, in good years, generated very high average yields. Careful attention to the timing of the water flowing into and out of the basins was required. This was a matter of local organization but it was of course a concern to the king, and we see officials being instructed on such matters throughout Egyptian history. Improvement in this natural system led to the second type of irrigation, artificial irrigation. Improvements came in the building of feeder and drainage canals, and the building of transverse dikes to divide the natural basins of land into smaller production units. Such artificial irrigation of the fields is attested at the every beginning of unified Egyptian history (The so-called “Scorpion Macehead” depicting the king clearing a canal ca. 3100 BC), and the clearly documented artificial canals used to build the pyramids in the Old Kingdom militates against the proposed “irrigation revolution” in Egypt during the First Intermediate Period (2160-2055 BC).[[37]](#footnote-37)

Butzer (2001) has posited two, not mutually exclusive, models of the development of artificial irrigation. The first suggests that improvements in the natural flooding and recession of the river came as a response to environmental stress. Low flood water prompted local farmers to cut sluices in the levees to allow for more water to come into the basins. This in turn may have led to more permanent structures of floodwater control, and the division of the land into small units. A second model is linked to the social stratification that is well documented from the early history of Egypt on. The hierarchic social organization of Egypt led to the working of land within family and other social groups and split holding of land to reduce localized risk of crop failure. This method of exploitation in turn led to increased productivity and a concomitant rise in population. The forced demand of a rising population produced greater pressure on the land that led to the need to expand the arable base, a need that also brought further development of irrigation networks. Both models presuppose a diffused, locally controlled response to the inter-annual variability of the river, and only limited intervention by the central state.

Technological improvements in irrigation methods were minimal, and were introduced from outside of Egypt. The first improvement, the *shaduf*, a counter-weighted pole and bucket mechanism introduced from the Near East during the New Kingdom (ca. 1350 BC), allowed some lifting of water onto fields and gardens. Like the animal driven waterwheel known as the *saqiya* that is first documented and was probably first introduced in Egypt in the third century BCE, probably at a time of major crisis, these mechanical lifting devices did not expand the arable land significantly until the Roman period but were used instead in the intensive agrarian settings of orchards and vineyards.[[38]](#footnote-38) Central state intervention, experimentation, expansion of the arable land was limited, but is documented for al historical periods; it was not until the nineteenth century, however, that the combination of a mercantilist government, massive new deep canal dredging, new cash crops like cotton and sugar cane, and barrage and weir technology allowed for large-scale perennial irrigation.[[39]](#footnote-39) The building of barrages and the High Dam at Aswan added the necessity for centralized control, directed by the Ministry of Public Works and Water Resources, a government bureau dating back to 1836 and the rule of Mohammed Ali. In fact really only to 1964 when the maintenance of the water supply became its sole portfolio, in what has became a very complex hydrologic system (Hvidt 1998:10-12). Water management by the state did not reach this level of complexity in antiquity. Nor did the competition for access to water appear to have been a serious issue in ancient times (Butzer 1984).

The connection between irrigation agriculture and the structure of the state is a subject that has generated fierce debate about the organization and concentration of power in irrigation societies. Earlier scholarship on Asia and the Near East has often noted causal links between “hydraulic” agriculture and centralized power. Egypt is an excellent case study in how irrigation societies create intensive, cooperative local irrigation ecologies. In an important article Chris Eyre (2004) has sketched the intricate connections between irrigation and local society in Egyptian history. He produces a composite image of Egypt from the Old Kingdom to the Ptolemaic period. Throughout Egyptian history, the central state, through images, ritual and bureaucratic command, stressed order. Emphasis was placed on measuring the Nile flood, carefully monitored at Nilometers with a mark for the sign of life, an indication that sufficient flood-waters would be attained that year. Such bureaucratic orderliness, however, disguises the local complexities and variabilities of the irrigated landscape (Eyre 2004). Unlike irrigation after 1820 when a much larger system of interconnected basins was created, the ancient system was highly local and small scale in its operation. It required no management or coordination, and indeed very little coerced labor to maintain the system.[[40]](#footnote-40) Even in the Ptolemaic period, a time in which it has been supposed there was a strong central state that intervened heavily in local economies, land management and so on, there was a balance between state economic interest and local management. In the Fayyum (Thompson), a region that had the most direct state presence, where the arable was trebled and settled in the early Ptolemaic period, the local character of irrigation and agricultural production still prevailed.

Local irrigation and production of crops in irrigation basins required a good deal of cooperation to maintain the irrigation canals, to mange the timing of water let onto fields, drainage, sowing and so on.[[41]](#footnote-41) Here is a great contrast to places like ancient Attica in Greece where individual family farms were the norm.[[42]](#footnote-42) As Eyre rightly stresses, such individual family farms were impossible in the Egyptian environment. It is the solidarity of the irrigation basin, of the village that was the key to agriculture in Egypt. Such a system is documented also in other places. Park’s analysis of the Middle Senegal river flood recession agricultural system in west Africa, for example, provides a useful model for the manner in which kinship groups hold land, provide access to family land to others by contract.[[43]](#footnote-43) Family groups managed land portfolios, held individually in inherited “shares” that were dispersed geographically to reduce risk. Decisions regarding planting and working the land is made each year depending on local water and soil conditions. It was a flexible response to a chaotic environment but one that could produce impressive returns per unit of labor.[[44]](#footnote-44)

Park’s model is generally a good one for ancient Egypt. Gradually, temples and the king asserted managerial control over a good amount of land in periods of centralized control. Such control over the flood basin land was very often managed by temple estates, large tracts of land that were nominally with the temple domain but held privately or leased out or worked by temple dependents in a complex local agricultural system. The system of property is complex. Individualized private property in the basins did not exist because it was not practicable in such a system. Rather, later legal documents describe a system of a “spectrum of rights” in land that was often held in families but could be privately leased or sold. The Egyptian system, rather like that discussed by Park was also one of a Hohfeldian bundle of rights and obligations that connected the king and the temples (collecting taxes and rents) to local family/status groups responding to the flood.[[45]](#footnote-45)

The common holding of property, essentially conveyable usufructuary rights, rather than individualized private property, in kinship/status groups, as Park suggests for the Senegal basin, was not a matter of the cost of enclosure but, rather due to the fact that a hierarchical social system in a chaotic environment made reallocation of resources annually an efficient solution. Such a system would have been reinforced by the necessity of group cooperation in maintaining the irrigation canals, the timing of water into the basins and so on. In certain parts of Egypt with a higher density population, stronger private property rights, which are documented for Upper Egypt between Thebes and Aswan for example, may have prevailed (Monson). The bridge to the central state was the local temple, at least in many areas which coordinated land tenure in its region, and into which the king played a ritual role of chief priest in the local cult.[[46]](#footnote-46) Temples (I speak here about the major state temples as opposed to small local shrines and smaller regional temples) held portfolios of land distributed throughout a large area and served as administrative and management (including the management of risk) centers. Temples provided employment, were the location of local festivals, the center of cult, symbolically the guarantor of stability and the social order, and conduit through which the king ruled. The hierarchical social system that evolved around flood recession agriculture and common property holdings, thus, would have created a major barrier to the formation of Athenian style democracy. But the important point is that the Egyptian system of governance created an equilibrium often lasting many centuries.

Mann suggests that once Egypt became a territorially centralized state the state was “well-nigh continuous.”[[47]](#footnote-47) If by “state” we mean that a single king controlled the Delta and the river valley up to Aswan that is not quite true. Indeed one of the most characteristic features of Egyptian history are the dynastic cycles, centralized states alternating with phases of smaller polities. The so-called “Intermediate period” between two centralized dynastic cycles is associated with demographic decline, a lack of central institutions and thus political fragmentation and little monumental building. Mann’s emphasis on the weakness of kings and their consequent reliance on elites is correct.[[48]](#footnote-48) We must also note that the Egyptian Nile valley and Delta was hardly uniformly settled. An important feature of settlement patterns in Egypt, especially in the middle of the river valley, is the alternation between new settlement and abandonment of sites because of the failure of the ability to control and sustain irrigation networks.

The correlation between long term inter-annual variability of the flood of the Nile river (discussed below) and centralized governance has been summarized by Bell (1971, 1975) and Butzer (1980): the decline in flood volume between Dynasties 1 and 2 (roughly estimated at -30%); Dynasty 7-8 and the First Intermediate period, Dynasty 13 and the Second Intermediate Period, and Dynasty 20 and the early Third Intermediate Period. Other factors, dynastic disputes, long-lived monarchs (Pepi II at the end of Dynasty 6), institutional weakness and external threats played a role in central state collapse. But it seems clear from the flood records that the relationship between centralized phases of Egyptian political history and optimal flooding of the river was correlated, and thus that the politically fragmented periods of Egyptian history are also associated to some extent with Nile flood deficiencies.

Once the Egyptian state was formed the pharaoh was at the center of state ideology and political power for as long as a central state existed. Egyptian governance has been categorized as “Authoritarian.” But this is too simplistic. The despotic nature of state ideology was probably a result of the local character of the Egyptian system, and the requirement of the king to be elevated above the diffuse, socially stratified local power structures.[[49]](#footnote-49) Even the Ptolemies, whose intervention in Egypt in the late fourth century BC has unique characteristics, maintained this pharaonic ideology. While much scholarship on Egyptian kingship has focused on this ideology. And the images and rituals of kingship, the function of Egyptian kingship was primarily fiscal.[[50]](#footnote-50)

The case of Egypt, with its ancient tradition of powerful kings and a hierarchic bureaucracy, would appear to be an exception to Ernst Gellner’s social model, the natural tendency of political fragmentation and high costs alleviated by the strong “caging effect” of the river valley that achieved nearly a “unitary social system”.[[51]](#footnote-51) But the bureaucracy was limited in its effectiveness, and the pharaoh relied on fostering the loyalty of the local elite through a political system that sanctioned rent seeking by them in exchange for loyalty to the center, and the requirement of mustering local labor when required. In fact the key to central power in Egypt was the ability of the king, through the local elite, to muster local labor––for military campaigns (before a standing army was organized during the New Kingdom), canal clearance, expeditions to quarry stone–– and, of course, to tax and redistribute agricultural production through the local temples. In periods of poor Nile flooding, however, the political structure linking villages, to district (nome) capitals, to the political center, in an “internested hierarchy” of population centers was often severed.[[52]](#footnote-52) There was in Egypt, to be sure, a “centralising principal” strengthened by the near monopoly of the king on image and text. Phrases such as the “water of pharaoh” (i.e. “public canal”) show the extent of royal ideology, but it does not measure royal intervention into local economies. The assignment of rights to land, especially new land, would also have been a royal prerogative, the normal mechanism of which was the gift of land to officials and to soldiers. Inter-village and regional cooperation could also be strengthened by the common practice of split holdings of land and the religious rituals of the temple estates, but there were no central state institutions that can be associated with control of the irrigation network.[[53]](#footnote-53)

This political response, as in other irrigation societies, created a bottom heavy or “feudal” social organization. The irrigation of fields was organized around the flood basins. The cleaning of canals, the protection of the dikes, the measurement of the flood, the lending of seed, the survey of the fields, and the payment of rent and tax from the land, were all organized at the local level through local institutions (temples) yet with obvious great concern of the king and the organs of the central state. The “social cage” of the river did allow the central state to dominate the economy, in distribution and in trade, and the elites were synonymous with the “state.” The state faced no internal rivals, there were no powerful city-states as in Mesopotamia to serve as counterweight to royal power.[[54]](#footnote-54)

If the political relationships were subtler and more complex, one overriding factor that created major differences in rural production and social structure between the classical world and Egypt remained. That factor is the Nile itself. But the influence goes in the opposite direction. Irrigation did not lead to authoritarian rule, as per Wittfogel. Rather, the environmental constraint caused by the Nile river corridor that flowed through a desert captured a population that created the means of centralized political control and taxation. In the final analysis, it was the Nile flood regime that acted as the real despot, the real power of which was the “social cage” created by the rich soil of the flood plain juxtaposed to the harsh desert environment on either side of it. The state, its institutions, and individual farmers had to respond and to adjust to the basic forces of the annual inundation and its recession. The flood could not be altered, only contained, and the population was quite effectively “caged” in the river corridor.[[55]](#footnote-55) The rural population itself was organized around a hierarchical village structure, complex social networks around land tenure and tax obligations and a cohesive group solidarity focused on production in an irrigated environment.[[56]](#footnote-56) The need to control a *diffused* irrigated landscape led not to despotic kings who claimed ownership of the entire state and its apparatus, but to the development of bureaucracy and a “centralizing principal.”[[57]](#footnote-57) There never was any connection between irrigation and centralized state power outside of the concern for revenue.[[58]](#footnote-58) The king could be a director, but it was the actors-- the local elites and the growing bureaucracy-- who were the players on the stage of a dynamic and variable ecosystem. The outcome could be rather different than the script. We come to a subtler understanding of political power in Egypt.[[59]](#footnote-59)

There was no despotic centralized state power as a consequence of irrigation, there was no state bureaucracy in charge of managing the irrigation system in ancient Egypt or under the Ptolemies. The environment led to a flexible state response, not to centralized planning of the economy (or anything else for that matter). The king could set the tone, send signals about expectations, display aspects of the divine, but the bureaucracy was set apart. The Egyptian king functioned, as the ancient texts precisely say, as the center of order, of cosmos, political stability in a chaotic world. The pharaoh was the center of the state equilibrium (note the extensive semiotics of order associated with Egyptian kingship), and that equilibrium in large part was dictated by the Nile river. The king, thus, served as the link between centers of production, as the coordinator of the state system. This is often neglected in discussions of Egyptian kingship. But it is the most important aspect of the institution, for pharaoh stood as the main institution that linked agricultural production in local basins to the central state apparatus.

*the system the shields both the society and the individual also suffers from an innate lack of pliancy. The instability threshold of complex cultural systems tends to be high in proportion to the number of negative-feedback mechanisms. This very multiplicity of components increases the probability of a chance concatenation of negative inputs. For example, the unexpected coincidence of poor leadership, external political stress, and environmental perturbation can trigger a catastrophic train if mutually reinforcing events which the system cannot absorb.*

*Viewed over a span of five millennia, Egypt as well as Mesopotamia exemplifies the inherent diachronic dynamism of an adaptive system characterized by a particular social and natural environment.*

*The Egyptian case outlined in this paper suggests strongly that environmental stress is a real -- in fact, a powerful-- variable among the many that make probabilistic projections difficult if not impossible. It further suggests a need for a methodology to investigate such stress in the archaeological or historical; record, in particular, the identification of stress points and potential thresholds, and their systematic evaluation*.[[60]](#footnote-60)

1. On “social caging” see Mann (1986). [↑](#footnote-ref-1)
2. Said (1993). The Moulouya, in Morocco, 520 km in length, drains today 53, 500km2. [↑](#footnote-ref-2)
3. Butzer (1999:570). [↑](#footnote-ref-3)
4. Hvidt (1998:2). [↑](#footnote-ref-4)
5. Butzer (1984); Hassan (1994), Seidlmayer (2001), Eyre (2004). [↑](#footnote-ref-5)
6. Fraedrich *et al*. (1997). [↑](#footnote-ref-6)
7. Said (1993:125-26); Hassan (xxxx). [↑](#footnote-ref-7)
8. They have been discussed by Bell, (1971), (1975); Butzer (xxxx); Seidlmeyer (2001). Bonneau (1969) provides known subjective observations collected from Greek papyri from Ptolemaic to late Roman times. [↑](#footnote-ref-8)
9. Eyre (2004:161-62). [↑](#footnote-ref-9)
10. Below….. [↑](#footnote-ref-10)
11. Manning (2010), with literature. [↑](#footnote-ref-11)
12. Hdt. 2.5. [↑](#footnote-ref-12)
13. Thonemann (2011:19). [↑](#footnote-ref-13)
14. Horden and Purcell (2000:45; 397). Bagnall (2005). See Bresson (2005), stressing connectivity. [↑](#footnote-ref-14)
15. Bagnall (2005:340). [↑](#footnote-ref-15)
16. A survey of the evidence in Steel (2010). [↑](#footnote-ref-16)
17. Steel (2010:472-73). [↑](#footnote-ref-17)
18. Well summarized recently by Moreno García (2015). See Menu on evolution of demotic contracts [↑](#footnote-ref-18)
19. Broodbank (2013:39-40). [↑](#footnote-ref-19)
20. Good recent survey of these regions in Wilkinson, ed. (2007). [↑](#footnote-ref-20)
21. Bowman (2009:181). Delta settlements are discussed by Trampier (2014). Cf. Butzer (2002). [↑](#footnote-ref-21)
22. Blouin (2014) for the Roman period; further bellow xxx. [↑](#footnote-ref-22)
23. Aristotle, *Met.* 361b35-362a2. [↑](#footnote-ref-23)
24. Park (1992). [↑](#footnote-ref-24)
25. Totman (1993:15). [↑](#footnote-ref-25)
26. Mann (1986). [↑](#footnote-ref-26)
27. For the basic "labor exploitation" model of state formation, see Allen (1997). [↑](#footnote-ref-27)
28. Wittfogel (1957). [↑](#footnote-ref-28)
29. Butzer (1996). [↑](#footnote-ref-29)
30. For Hawaii, the classic critique is Earle (1978). [↑](#footnote-ref-30)
31. Cf. Steward (1955), reflecting Wittfogel's influence. [↑](#footnote-ref-31)
32. Butzer (1999). [↑](#footnote-ref-32)
33. Below,… [↑](#footnote-ref-33)
34. Rathbone (1994:35). The average gradient of the Nile river in Egypt proper is virtually flat, about 1m in 10km, or 1:10,000. [↑](#footnote-ref-34)
35. Butzer (1999:382). The essential local control, centered on officials in the villages, is well documented in Ptolemaic times and later. See Bonneau (1993). [↑](#footnote-ref-35)
36. Butzer (1999). [↑](#footnote-ref-36)
37. Schenkel (1978). [↑](#footnote-ref-37)
38. Cf. Butzer (1976:41-51); Eyre (1994). [↑](#footnote-ref-38)
39. Marsot (1984:137-61). [↑](#footnote-ref-39)
40. Emphasized well by Eyre (2004). [↑](#footnote-ref-40)
41. Said (1993:188-207). [↑](#footnote-ref-41)
42. The situation on the Greek mainland is in fact more complicated. Large estates were worked by dependent labor in Sparta, in Crete and Thessaly large private estates were worked by slaves, and small family farms were found, most commonly in Attica. See the important analysis of Greek agricultural labor in Jameson (1992). [↑](#footnote-ref-42)
43. Park (1992). [↑](#footnote-ref-43)
44. Park (1992:93). [↑](#footnote-ref-44)
45. Park (1992:96); Manning (1995); Monson…. [↑](#footnote-ref-45)
46. The system I describe is based largely on documents from Upper Egypt. Other areas of Egypt are less well documented, but we would be wrong to conclude that tenure arrangements were uniform throughout. [↑](#footnote-ref-46)
47. Mann (1986:110). [↑](#footnote-ref-47)
48. Mann (1986:161ff). [↑](#footnote-ref-48)
49. Cf. Mann (1986:97-98). [↑](#footnote-ref-49)
50. On Egyptian kingship, see O’Connor and Silverman (1995). [↑](#footnote-ref-50)
51. Mann (1986:114). [↑](#footnote-ref-51)
52. Skinner quoted in Wilkinson (2000:5). [↑](#footnote-ref-52)
53. Eyre (2000); Bonneau (1993). [↑](#footnote-ref-53)
54. Ekholm and Friedman (1979). [↑](#footnote-ref-54)
55. Mann (1986). [↑](#footnote-ref-55)
56. For ancient Egypt, see Eyre (2004). Bali’s social organization centered around irrigation are instructive. See Lansing (1991); (2006). [↑](#footnote-ref-56)
57. Chaudhuri (1990:261). [↑](#footnote-ref-57)
58. O’Leary (1989:252). Cf. Butzer (1976:110). [↑](#footnote-ref-58)
59. Eyre (forthcoming). [↑](#footnote-ref-59)
60. Butzer (1984:112). [↑](#footnote-ref-60)